THAT WHICH IS CLAIMED IS:

1. A process for the N-halogenation of a compound having at least one N-halogenatable amido or imido nitrogen atom in the molecule, which process comprises:

concurrently, or substantially concurrently, feeding (a) a compound having in the molecule at least one N-halogenatable amido or imido nitrogen atom, (b) an inorganic base, (c) a brominating agent and/or a chlorinating agent, and (d) water,

said (a), (b), (c), and (d) being fed individually and/or in any combination(s) whereby the feeds come together in a reaction zone,

said (a), (b), (c), and (d) being fed in proportions such that at least one said amido or imido nitrogen atom is substituted by a bromine or chlorine atom, thereby forming product which precipitates in the liquid phase of an aqueous reaction mixture, and such that the pH of said liquid phase is continuously or substantially continuously maintained in the range of about 5.5 to about 8.5 during all or substantially all of the time said feeding is occurring.

2. A process of Claim 1 wherein said pH is in the range of about 6.5 to about 8.5.

3. A process of Claim 1 wherein at least (a) and (b) are fed in the form of a single preformed aqueous solution or slurry.

4. A process of Claim 1 wherein at least (a) is fed in the form of a separate preformed aqueous solution or slurry, and wherein at least (b) is fed in the form of a separate preformed aqueous solution or slurry.

5. A process of Claim 1 wherein when starting up said process, said feeding is initiated into a reactor containing (i) a solids-containing heel of a reaction mixture from a prior reaction in which the product to be formed had been formed, or (ii) a solids-free mother liquor of a reaction mixture from a prior reaction in which the product to be formed had been formed.

6. A process of Claim 1 wherein said feeding is initially to a mixing device which produces an effluent stream formed from (a) and (b), or (a) and (d), (b) and (d), or (c) and (d), or (a), (b), and (d), and wherein the effluent stream is fed into a reaction vessel containing a larger volume of the aqueous reaction mixture; wherein said stream is subjected to dilution in the aqueous reaction mixture before the temperature of said effluent stream exceeds about 90°C; and wherein the temperature of the aqueous reaction mixture is maintained in the range of about 0 to about 90°C during all or substantially all of the time said feeding is occurring.

7. A process of Claim 6 wherein said mixing device is a static mixer, and wherein the effluent stream from the mixer is being fed subsurface to the liquid phase of the aqueous reaction mixture.

8. A process of Claim 6 wherein said mixing device is a jet mixer producing a high velocity stream, which stream is being fed subsurface to the liquid phase of the aqueous reaction mixture.

9. A process of Claim 1 wherein said aqueous reaction mixture is at one or more temperatures in the range of about 0 to about 90°C.

10. A process of Claim 1 wherein (a) is a 5,5-dialkylhydantoin in which each alkyl group has, independently, up to about three carbon atoms; wherein (b) is a basic salt or oxide of a water-soluble alkali metal or an alkaline earth metal; wherein the amount of such base

is the stoichiometric quantity, or is substantially the stoichiometric quantity, theoretically required to deprotonate at least one nitrogen atom of said hydantoin; wherein (c) is (i) bromine, (ii) chlorine, (iii) bromine chloride, (iv) an alkali metal bromide or aqueous solution thereof, or an alkaline earth metal bromide or aqueous solution thereof, and chlorine, or hypochlorite salt or aqueous hypochlorite solution in amounts sufficient to generate bromine *in situ*, or (v) a combination of any two or more of (i), (ii), (iii), and (iv); wherein at least all or such portion of (c) that is in the vapor state, if any, is fed subsurface to the liquid phase of the aqueous reaction mixture; wherein the temperature of the aqueous reaction mixture is continuously or substantially continuously in the range of from about 30 to about 90°C during all or substantially all of the time said feeding is occurring; and wherein the proportions of the feeds are such that the total amount of (c) being fed to N-halogenate the 5,5-dialkylhydantoin being fed are such that there are in the range of about 3.8 to about 4.2 atoms of halogen per molecule of 5,5-dialkylhydantoin.

11. A process of any of Claims 1, 2, or 9 wherein said process is conducted in a continuous mode in which, under steady state conditions, said feed(s) are maintained such that the ratio of (i) the volume of said reaction mixture in liters to (ii) the moles of said compound of (a) being fed to the reaction mixture per minute is in the range of about 10 to about 100 liters per mole per minute.

12. A process of any of Claims 1, 2, or 9 wherein said process is conducted in batch mode in at least one reactor and wherein, until the volume of the reaction mixture reaches 50 percent of the total volume of the reactor(s), the feeds to said reaction mixture are maintained such that the ratio of (i) the volume of said reaction mixture in liters to (ii) the moles of said compound of (a) being fed to the reaction mixture per minute is in the range of about 10 to about 100 liters per mole per minute; and wherein, when the volume of the reaction mixture is 50 percent or more of the total volume of the reactor(s), the feeds to said reaction mixture are maintained such that the ratio of (i) the volume of said reaction mixture

in liters to (ii) the moles of said compound of (a) being fed to the reaction mixture per minute is in the range of about 30 to about 60 liters per mole per minute.

13. A process for the N-halogenation of a compound having in the molecule at least one halogenatable amido or imido functional group, which process comprises concurrently feeding into a reaction zone:

A) separate feeds of (i) an aqueous solution or slurry formed from an inorganic base and a compound having in the molecule at least one halogenatable amido or imido nitrogen atom, and (ii) a brominating agent and/or a chlorinating agent; or

B) at least three separate feeds, one of which is a brominating agent and/or a chlorinating agent, and at least two other feeds, at least one of which is selected from (a) and (b); and at least one of which is selected from (c) and (d), wherein

(a) is an aqueous solution or slurry formed from an inorganic base,

(b) is an aqueous solution or slurry formed from an inorganic base and a compound having in the molecule at least one halogenatable amido or imido nitrogen atom,

(c) is a compound having in the molecule at least one halogenatable amido or imido nitrogen atom, and

(d) is an aqueous solution or slurry formed from a compound having in the molecule at least one halogenatable amido or imido nitrogen atom;

in proportions such that at least one said amido or imido nitrogen atom is substituted by a bromine or chlorine atom, thereby continuously or substantially continuously forming product which precipitates in the liquid phase of an aqueous reaction mixture during all or substantially all of the time said concurrent feeding is occurring, and such that the pH of said liquid phase is continuously or substantially continuously maintained in the range of about 5.5 to about 8.5 during all or substantially all of the time said concurrent feeding is occurring.

14. A process of Claim 13 wherein said pH is in the range of about 6.5 to about 8.5.

15. A process of Claim 14 wherein said compound having in the molecule at least one halogenatable amido or imido nitrogen atom is a cyclic amide or cyclic imide; and wherein said brominating agent and/or chlorinating agent is bromine, chlorine, bromine chloride, or a combination of any two or all three of them, and is fed subsurface to the liquid phase of said reaction mixture.

16. A process of Claim 14 wherein said compound having in the molecule at least one halogenatable amido or imido nitrogen atom is a cyclic amide or cyclic imide; and wherein said brominating agent and/or chlorinating agent is (i) an alkali metal bromide or an alkaline earth metal bromide, and (ii) chlorine, a hypochlorite salt, or an aqueous hypochlorite solution in amounts sufficient to generate bromine *in situ*, and if (ii) is chlorine, at least the chlorine is fed subsurface to the liquid phase of said reaction mixture.

17. A process of Claim 14 wherein the inorganic base is a water-soluble basic salt or oxide of an alkali metal or an alkaline earth metal, and wherein the amount of such base is the stoichiometric quantity, or is substantially the stoichiometric quantity, theoretically required to deprotonate at least one imido group of said compound or to fully or partially deprotonate at least one amido group of said compound.

18. A process of Claim 13 wherein said aqueous reaction mixture is at one or more temperatures in the range of about 0 to about 90 °C, and wherein if said brominating agent and/or chlorinating agent is in the form of a vapor, said vapor is fed subsurface to the liquid phase of the reaction mixture.

19. A process of any of Claims 13-16 wherein said process is conducted in a continuous mode in which, under steady state conditions, said feed(s) are maintained such that the ratio of (i) the volume of said reaction mixture in liters to (ii) the moles of said compound having in the molecule at least one halogenatable amido or imido nitrogen atom being fed to the reaction mixture per minute is in the range of about 10 to about 100 liters per mole per minute.

20. A process of any of Claims 13-16 wherein said process is conducted in a batch mode in at least one reactor and wherein, until the volume of the reaction mixture reaches 50 percent of the total volume of the reactor(s), the feeds to said reaction mixture are maintained such that the ratio of (i) the volume of said reaction mixture in liters to (ii) the moles of said N-halogenatable compound of (a) being fed to the reaction mixture per minute is in the range of about 10 to about 100 liters per mole per minute; and wherein, when the volume of the reaction mixture is 50 percent or more of the total volume of the reactor(s), the feeds to said reaction mixture are maintained such that the ratio of (i) the volume of said reaction mixture in liters to (ii) the moles of N-halogenatable compound being fed to the reaction mixture per minute is in the range of about 30 to about 60 liters per mole per minute.

21. A process of ~~Claim 13~~ wherein said pH is in the range of about 6.8 to about ~~7.2~~.

22. A process of Claim 21 wherein said compound having in the molecule at least one halogenatable amido or imido nitrogen atom is a 5-alkyl hydantoin or a 5,5-dialkylhydantoin; wherein the temperature of said reaction mixture is in the range of about 20 to about 80°C, and wherein, if all or part of said brominating agent and/or chlorinating agent is in the form of a vapor, said vapor is fed subsurface to the liquid phase of said reaction mixture.

23. A process of Claim 13 wherein the proportions of water, inorganic base, and said compound being fed are such that:

A) where the inorganic base has a monovalent cation, there are from about 0.5 to about 2.5 moles of halogenatable amido or imido nitrogen atoms and from about 0.5 to about 2.5 moles of the base, per liter of water; and

B) where the base has a divalent cation, there are about 0.5 to about 2.5 moles of halogenatable amido or imido nitrogen atoms and from about 0.25 to about 1.25 moles of the base, per liter of water.

24. A process of Claim 13 wherein the proportions of water, inorganic base, and said compound being fed are such that:

A) where the inorganic base has a monovalent cation, there are from about 1.0 to about 1.5 moles of halogenatable amido or imido nitrogen atoms and from about 1.0 to about 1.5 moles of the base, per liter of water; and

B) where the base has a divalent cation, there are about 1.0 to about 1.5 moles of halogenatable amido or imido nitrogen atoms and from about 0.5 to about 0.75 moles of the base, per liter of water.

25. A process of Claim 13 wherein the process is conducted in a batch mode.

26. A process of Claim 25 wherein during at least about 80% of the period of time said concurrent separate feeds are being carried out, precipitate is being formed that has a purity of at least about 97%.

27. A process of Claim 13 wherein the process is conducted in a continuous mode; wherein the temperature of the aqueous reaction mixture is in the range of about 20 to about 90°C; and wherein said inorganic base and said compound having in the molecule at least one

halogenatable amido or imido nitrogen atom are fed either as separate solutions or slurries in water or as a single solution or slurry in water.

28. A process of Claim 27 wherein during steady-state operation, precipitate is continuously being formed that (a) has a purity of at least about 97%, and (b) is formed in a continuous or substantially continuous yield of at least about 85% based on the amount of the compound having at least one halogenatable amido or imido nitrogen atom being fed to the reactor.

29. A process of Claim 13 wherein said compound having at least one amido or imido functional group in the molecule is a hydantoin in which each of the two substituents in the 5-position is, independently, a hydrogen atom or a hydrocarbyl group.

30. A process of Claim 29 wherein said hydantoin is a 5-alkyl hydantoin or a 5,5-dialkylhydantoin.

31. A process of Claim 30 wherein said process is conducted in a continuous mode in which, under steady state conditions, said feed(s) are maintained such that the ratio of (i) the volume of said reaction mixture in liters to (ii) the moles of said hydantoin being fed to the reaction mixture per minute is in the range of about 10 to about 100 liters per mole per minute.

32. A process of Claim 31 wherein said ratio is in the range of about 30 to about 60 liters per mole per minute.

33. A process of Claim 30 wherein said process is conducted in batch mode in at least one reactor and wherein, until the volume of the reaction mixture reaches 50 percent of the total volume of the reactor(s), the feeds to said reaction mixture are maintained such that

the ratio of (i) the volume of said reaction mixture in liters to (ii) the moles of said compound of (a) being fed to the reaction mixture per minute is in the range of about 10 to about 100 liters per mole per minute; and wherein, when the volume of the reaction mixture is 50 percent or more of the total volume of the reactor(s), the feeds to said reaction mixture are maintained such that the ratio of (i) the volume of said reaction mixture in liters to (ii) the moles of said hydantoin being fed to the reaction mixture per minute is in the range of about 30 to about 60 liters per mole per minute.

34. A process of Claim 33 wherein, until the volume of the reaction mixture reaches 50 percent of the total volume of the reactor(s), the feeds to said reaction mixture are maintained such that said ratio is in the range of about 20 to about 80 liters per mole per minute.

35. A process of Claim 13 wherein said compound having in the molecule at least one halogenatable amido or imido nitrogen atom is a 5,5-dialkylhydantoin in which each alkyl group has, independently, up to about six carbon atoms; wherein said inorganic base is a basic salt or oxide of an alkali metal or an alkaline earth metal; wherein the amount of such base is the stoichiometric quantity, or is substantially the stoichiometric quantity, theoretically required to deprotonate at least one nitrogen atom of said hydantoin; wherein said brominating agent and/or chlorinating agent is (i) bromine, (ii) chlorine, (iii) bromine chloride, (iv) an alkali metal bromide or aqueous solution thereof, or an alkaline earth metal bromide or aqueous solution thereof, and chlorine, or hypochlorite salt or aqueous hypochlorite solution in amounts sufficient to generate bromine *in situ*, or (v) a combination of any two or more of (i), (ii), (iii), and (iv); wherein at least all or such portion of brominating agent and/or chlorinating agent that is in the vapor state, if any, is fed subsurface to the liquid phase of the aqueous reaction mixture; wherein the temperature of the aqueous reaction mixture is continuously or substantially continuously maintained in the range of from about 20 to about 80°C during all or substantially all of the time said feeding is occurring; and

wherein said process is conducted in a continuous mode in which, under steady state conditions, the feeds to said reaction mixture are maintained such that the ratio of (i) the volume of said reaction mixture in liters to (ii) the moles of said 5,5-dialkylhydantoin being fed to the reaction mixture per minute is in the range of about 30 to about 60 liters per mole per minute.

36. A process of Claim 13 wherein said compound having in the molecule at least one halogenatable amido or imido nitrogen atom is a 5,5-dialkylhydantoin in which each alkyl group has, independently, up to about six carbon atoms; wherein said inorganic base is a basic salt or oxide of an alkali metal or an alkaline earth metal; wherein the amount of such base is the stoichiometric quantity, or is substantially the stoichiometric quantity, theoretically required to deprotonate at least one nitrogen atom of said hydantoin; wherein said brominating agent and/or chlorinating agent is (i) bromine, (ii) chlorine, (iii) bromine chloride, (iv) an alkali metal bromide or an alkaline earth metal bromide, and chlorine, a hypochlorite salt, or an aqueous hypochlorite solution in amounts sufficient to generate bromine *in situ*, or (v) a combination of any two or more of (i), (ii), (iii), and (iv); wherein at least all or such portion of said brominating agent and/or chlorinating agent that is in the vapor state, if any, is fed subsurface to the liquid phase of the aqueous reaction mixture; wherein the temperature of said aqueous reaction mixture is continuously or substantially continuously maintained in the range of from about 20 to about 80°C during all or substantially all of the time said feeding is occurring; wherein said process is conducted in a batch mode in at least one reactor; wherein, until the volume of the reaction mixture reaches 50 percent of the total volume of the reactor(s), the feeds to said reaction mixture are maintained such that the ratio of (i) the volume of said reaction mixture in liters to (ii) the moles of said 5,5-dialkylhydantoin being fed to the reaction mixture per minute is in the range of about 20 to about 80 liters per mole per minute; and wherein, when the volume of the reaction mixture is 50 percent or more of the total volume of the reactor(s), the feeds to said reaction mixture are maintained such that the ratio of (i) the volume of said reaction mixture

in liters to (ii) the moles of said 5,5-dialkylhydantoin being fed to the reaction mixture per minute is in the range of about 30 to about 60 liters per mole per minute.

37. A process of Claim 35 wherein said pH is in the range of about 6.8 to about 7.2.

38. A process of Claim 36 wherein said pH is in the range of about 6.8 to about 7.2.

39. A process of Claim 35 wherein said 5,5-dialkylhydantoin is 5,5-dimethylhydantoin.

40. A process of Claim 36 wherein 5,5-dialkylhydantoin is 5,5-dimethylhydantoin.

41. A process of Claim 39 wherein said pH is in the range of about 6.8 to about 7.2; wherein said temperature in the range of about 30 to about 70°C; and wherein said brominating agent and/or chlorinating agent is bromine.

42. A process of Claim 30 wherein said pH is continuously or substantially continuously maintained in the range of about 6.8 to about 7.2 during all or substantially all of the time said feeding is occurring; wherein said temperature of the aqueous reaction mixture is maintained in the range of about 30 to about 70°C during all or substantially all of the time said feeding is occurring; and wherein the brominating agent and/or chlorinating agent is bromine.

43. A process for the N-halogenation of a compound having at least one halogenatable amido or imido functional group in the molecule, which process comprises concurrently feeding into a reaction zone, separate feeds of (i) an aqueous solution or slurry

formed from an inorganic base and a compound having in the molecule at least one halogenatable amido or imido nitrogen atom, and (ii) a brominating agent and/or chlorinating agent in proportions such that at least one said amido or imido nitrogen atom is substituted by a bromine or chlorine atom and the resultant product precipitates in a liquid phase of a reaction mixture during all or substantially all of the time said concurrent feeding is occurring, and such that the pH of said mixture is continuously or substantially continuously maintained in the range of about 6.5 to about 8.5 during all or substantially all of the time said concurrent feeding is occurring.

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44. A process of Claim 43 wherein (ii) is bromine, chlorine, bromine chloride, or a combination of any two or all three of them, and is fed subsurface to the liquid phase of the reaction mixture.

45. A process of Claim 43 wherein (ii) is an alkali metal bromide or an alkaline earth metal bromide, and chlorine, a hypochlorite salt, or an aqueous hypochlorite solution in amounts sufficient to generate bromine *in situ*, and if (ii) is chlorine, said chlorine is fed subsurface to the liquid phase of the reaction mixture.

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46. A process of Claim 43 wherein the inorganic base is a water-soluble basic salt or oxide of an alkali metal or an alkaline earth metal, and wherein the amount of such base is the stoichiometric quantity, or is substantially the stoichiometric quantity, theoretically required to deprotonate at least one imido group of said compound or to fully or partially deprotonate at least one amido group of said compound.

47. A process of Claim 46 wherein said basic salt or oxide consists essentially of sodium oxide, sodium hydroxide, sodium carbonate, sodium bicarbonate, potassium oxide, potassium hydroxide, potassium carbonate, potassium bicarbonate, calcium oxide, calcium hydroxide, or a mixture of any two or more of them.

48. A process of Claim 43 wherein the pH is in the range of about 6.8 to about 7.2.

49. A process of Claim 43 wherein the temperature of said reaction mixture is in the range of about 0 to about 90°C, and wherein if (ii) is in the form of a vapor, (ii) is fed subsurface to the liquid phase of said reaction mixture.

50. A process of Claim 43 wherein the temperature of said reaction mixture is in the range of about 30 to about 70°C, and wherein if (ii) is in the form of a vapor, (ii) is fed subsurface to the liquid phase of said reaction mixture.

51. A process of Claim 43 wherein the proportions of water, inorganic base, and said compound being fed are such that:

A) where the inorganic base has a monovalent cation, there are from about 0.5 to about 2.5 moles of halogenatable amido or imido nitrogen atoms and from about 0.5 to about 2.5 moles of the base, per liter of water; and

B) where the base has a divalent cation, there are about 0.5 to about 2.5 moles of halogenatable amido or imido nitrogen atoms and from about 0.25 to about 1.25 moles of the base, per liter of water.

52. A process of Claim 43 wherein the proportions of water, inorganic base, and said compound being fed are such that:

A) where the inorganic base has a monovalent cation, there are from about 1.0 to about 1.5 moles of halogenatable amido or imido nitrogen atoms and from about 1.0 to about 1.5 moles of the base, per liter of water; and

B) where the base has a divalent cation, there are about 1.0 to about 1.5 moles of halogenatable amido or imido nitrogen atoms and from about 0.5 to about 0.75 moles of the base, per liter of water.

53. A process of Claim 43 wherein the process is conducted in a batch mode in at least one reactor and wherein, until the volume of the reaction mixture reaches 50 percent of the total volume of the reactor(s), the feeds to said reaction mixture are maintained such that the ratio of (i) the volume of said reaction mixture in liters to (ii) the moles of said N-halogenatable compound of (a) being fed to the reaction mixture per minute is in the range of about 10 to about 100 liters per mole per minute; and wherein, when the volume of the reaction mixture is 50 percent or more of the total volume of the reactor(s), the feeds to said reaction mixture are maintained such that the ratio of (i) the volume of said reaction mixture in liters to (ii) the moles of N-halogenatable compound being fed to the reaction mixture per minute is in the range of about 30 to about 60 liters per mole per minute.

54. A process of Claim 43 wherein the process is conducted in a continuous mode in which, under steady state conditions, said feed(s) are maintained such that the ratio of (i) the volume of said reaction mixture in liters to (ii) the moles of N-halogenatable compound being fed to the reaction mixture per minute is in the range of about 10 to about 100 liters per mole per minute.

55. A process of Claim 43 wherein said compound having at least one amido or imido functional group in the molecule is a hydantoin in which each of the two substituents in the 5-position is, independently, a hydrogen atom or a hydrocarbyl group.

56. A process of Claim 55 wherein said hydantoin is a 5-alkyl hydantoin or a 5,5-dialkylhydantoin.

57. A process of Claim 43 wherein when starting up said process, said feeding is initiated into a reactor containing (i) a solids-containing heel of a reaction mixture from a

prior reaction in which the product to be formed had been formed, or (ii) a solids-free mother liquor of a reaction mixture from a prior reaction in which the product to be formed had been formed.

58. A process for the production of a 1,3-dihalo-5,5-dimethylhydantoin, which process comprises concurrently feeding into a reaction zone (i) water, inorganic base, and 5,5-dimethylhydantoin, these being fed separately and/or in any combination(s), and (ii) a separate feed of a brominating agent and/or a chlorinating agent, in proportions such that during all or substantially all of the time the concurrent feeding is occurring 1,3-dihalo-5,5-dimethylhydantoin is formed and precipitates in the liquid phase of an aqueous reaction mixture, and in which the pH of said liquid phase is continuously or substantially continuously maintained in the range of about 6.5 to about 8.5 during all or substantially all of the time the concurrent feeding is occurring.

59. A process of Claim 58 wherein said pH is in the range of about 6.8 to about 7.2.

60. A process of Claim 58 wherein (ii) is bromine and is fed subsurface to the liquid phase of said reaction mixture.

61. A process of Claim 58 wherein (ii) is chlorine; a mixture of bromine and chlorine, fed separately or in combination; or bromine chloride; and is fed subsurface to the liquid phase of said reaction mixture.

62. A process of Claim 58 wherein (ii) is an alkali metal bromide or an alkaline earth metal bromide, and chlorine, a hypochlorite salt, or an aqueous hypochlorite solution in amounts sufficient to generate bromine *in situ*, and if chlorine is used it is fed subsurface to the liquid phase of said reaction mixture.

63. A process of Claim 58 wherein the temperature of said aqueous reaction mixture is in the range of about 20 to about 80°C.

64. A process of Claim 58 wherein the temperature of said aqueous reaction mixture is in the range of about 30 to about 70°C.

65. A process of Claim 58 wherein the temperature of said aqueous reaction mixture is in the range of about 40 to about 60°C.

66. A process of Claim 58 wherein the proportions of water, inorganic base, and 5,5-dimethylhydantoin being fed are such that:

A) where the inorganic base has a monovalent cation, there are from about 0.5 to about 2.5 moles of 5,5-dimethylhydantoin and from about 1.0 to about 5.0 moles of the base, per liter of water; and

B) where the base has a divalent cation, there are about 0.5 to about 2.5 moles of 5,5-dimethylhydantoin and from about 0.5 to about 2.5 moles of the base, per liter of water.

67. A process of Claim 58 wherein the proportions of water, inorganic base, and 5,5-dimethylhydantoin being fed are such that:

A) where the inorganic base has a monovalent cation, there are from about 1.0 to about 1.5 moles of 5,5-dimethylhydantoin and from about 2.0 to about 3.0 moles of the base, per liter of water; and

B) where the base has a divalent cation, there are about 1.0 to about 1.5 moles of 5,5-dimethylhydantoin and from about 1.0 to about 1.5 moles of the base, per liter of water.

68. A process of Claim 67 wherein (ii) is bromine; wherein said pH is in the range of about 6.8 to about 7.2; wherein the temperature of said aqueous reaction mixture is in the range of about 30 to about 70°C; and wherein if said temperature is above the boiling point of the bromine, the bromine is fed subsurface to the liquid phase said reaction mixture.

69. A process of Claim 67 wherein (ii) is bromine; wherein said base is sodium hydroxide, wherein said pH is in the range of about 6.8 to about 7.2; wherein the temperature of said aqueous reaction mixture is in the range of about 40 to about 60°C; wherein if said temperature is above the boiling point of the bromine, the bromine is fed subsurface to the liquid phase of said reaction mixture.

70. A process of Claim 58 wherein water, inorganic base, and 5,5-dimethylhydantoin of (i) are introduced as a feed solution formed from all three of them by mixing 5,5-dimethylhydantoin with an aqueous solution of inorganic base.

71. A process of Claim 70 wherein the inorganic base used in forming said feed solution is a water-soluble basic salt or oxide of an alkali metal or an alkaline earth metal; and wherein said pH is in the range of about 6.8 to about 7.2.

72. A process of Claim 58 wherein the inorganic base used in forming said feed solution consists essentially of sodium oxide, sodium hydroxide, sodium carbonate, sodium bicarbonate, potassium oxide, potassium hydroxide, potassium carbonate, potassium bicarbonate, calcium oxide, calcium hydroxide, or a mixture of any two or more of them; and wherein the amount of such base is the stoichiometric quantity, or is substantially the stoichiometric quantity, theoretically required to fully deprotonate the 5,5-dimethylhydantoin used in forming said feed solution.

73. A process of Claim 58 wherein the process is conducted in a batch mode by initiating the concurrent feeds of (i) and (ii) to a reactor containing (a) a solids-containing heel of a reaction mixture from a prior reaction in which the 1,3-dihalo-5,5-dimethylhydantoin to be formed had been formed, or (b) a solids-free mother liquor of a reaction mixture from a prior reaction in which the 1,3-dihalo-5,5-dimethylhydantoin to be formed had been formed, and discontinuing the concurrent feeds of (i) and (ii) when the reactor has been filled to the desired level.

74. A process of Claim 70 wherein the process is conducted in a batch mode by initiating the concurrent feeds of (i) and (ii) to the reactor containing (a) a solids-containing heel of a reaction mixture from a prior reaction in which the 1,3-dihalo-5,5-dimethylhydantoin to be formed had been formed, or (b) a solids-free mother liquor of a reaction mixture from a prior reaction in which the 1,3-dihalo-5,5-dimethylhydantoin to be formed had been formed, and discontinuing the concurrent feeds of (i) and (ii) when the reactor has been filled to the desired level.

75. A process of any of Claims 1, 13, 14, or 43 wherein the proportions of said brominating agent and/or chlorinating agent and said compound having in the molecule at least one halogenatable amido or imido nitrogen atom being fed are such that there are in the range of about 1.9 to about 2.1 atoms of halogen per halogenatable amido or imido nitrogen atom to be halogenated.

76. A process of any of Claims 58, 59, 60, 61, 62, or 69 wherein the proportions of the brominating agent and/or chlorinating agent and 5,5-dimethylhydantoin being fed are such that there are in the range of about 3.8 to about 4.2 atoms of halogen per molecule of 5,5-dimethylhydantoin.

77. A process of Claim 56 or 58 wherein (ii) is bromine and wherein the rate at which (i) and (ii) are being fed is such that the color of the reaction mixture is yellow to reddish yellow.

78. A process for the N-halogenation of a compound having at least one halogenatable amido or imido functional group in the molecule, which process comprises:

I) concurrently and continuously feeding into a reactor containing an aqueous reaction mixture:

A) separate feeds of (i) an aqueous solution or slurry formed from an inorganic base and a compound having in the molecule at least one halogenatable amido or imido nitrogen atom, and (ii) a brominating agent and/or a chlorinating agent; or

B) at least three separate feeds, one of which is a brominating agent and/or a chlorinating agent, and at least two other feeds, at least one of which is selected from (a) and (b); and at least one of which is selected from (c) and (d), wherein

(a) is an aqueous solution or slurry formed from an inorganic base,

(b) is an aqueous solution or slurry formed from an inorganic base and a compound having in the molecule at least one halogenatable amido or imido nitrogen atom,

(c) is a compound having in the molecule at least one halogenatable amido or imido nitrogen atom, and

(d) is an aqueous solution or slurry formed from a compound having in the molecule at least one halogenatable amido or imido nitrogen atom;

in proportions such that at least one said amido or imido nitrogen atom is substituted by a bromine or chlorine atom and a precipitate of the resultant product precipitates in the liquid phase of an aqueous reaction mixture during all or substantially all of the time said concurrent feeding is occurring, and such that the pH of said reaction

mixture is continuously or substantially continuously maintained ~~in the range of~~ about 5.5 to about 8.5 during all or substantially all of the time said concurrent feeding is occurring; and

II) periodically or continuously removing precipitate and a portion of the reaction mixture from the reactor.

79. A process of Claim 78 wherein the volume of the feeds to said reactor in I) and the volume of the precipitate and portion of the reaction mixture removed from said reactor in II) are equal or substantially equal so that the volume of reactor contents remains constant or substantially constant.

80. A process of Claim 78 wherein said pH is in the range of about 6.5 to about 8.5.

81. A process of Claim 78 wherein said pH is in the range of about 6.8 to about 7.2.

82. A process of Claim 78 wherein the temperature of said aqueous reaction mixture is in the range of about 20 to about 90°C, and wherein if said brominating agent and/or chlorinating agent is in the form of a vapor, said vapor is fed subsurface to the liquid phase of said reaction mixture in I).

83. A process of Claim 80 wherein the temperature of said aqueous reaction mixture is in the range of about 30 to about 70°C, and wherein if said brominating agent and/or chlorinating agent is in the form of a vapor, said vapor is fed subsurface to the liquid phase of said reaction mixture in I).

84. A process of Claim 78 wherein the proportions of water, inorganic base, and said compound being fed are such that:

A) where the inorganic base has a monovalent cation, there are from about 0.5 to about 2.5 moles of halogenatable amido or imido nitrogen atoms and from about 0.5 to about 2.5 moles of the base, per liter of water; and

B) where the base has a divalent cation, there are about 0.5 to about 2.5 moles of halogenatable amido or imido nitrogen atoms and from about 0.25 to about 1.25 moles of the base, per liter of water.

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85. A process of Claim 78 wherein the proportions of water, inorganic base, and said compound being fed are such that:

A) where the inorganic base has a monovalent cation, there are from about 1.0 to about 1.5 moles of halogenatable amido or imido nitrogen atoms and from about 1.0 to about 1.5 moles of the base, per liter of water; and

B) where the base has a divalent cation, there are about 1.0 to about 1.5 moles of halogenatable amido or imido nitrogen atoms and from about 0.5 to about 0.75 moles of the base, per liter of water.

86. A process of Claim 78 wherein said brominating agent and/or chlorinating agent is bromine, chlorine, bromine chloride, or a combination of any two or all three of them, and is fed subsurface to the liquid phase of the reaction mixture in I).

87. A process of Claim 78 wherein said brominating agent and/or chlorinating agent is an alkali metal bromide or an alkaline earth metal bromide and chlorine, a hypochlorite salt, or an aqueous hypochlorite solution in amounts sufficient to generate bromine *in situ*, and if chlorine is used, said chlorine is fed subsurface to the liquid phase of the aqueous reaction mixture in I).

88. A process of Claim 78 wherein said brominating agent and/or chlorinating agent is bromine, and wherein the bromine is fed subsurface to the liquid phase of the aqueous reaction mixture in I).

89. A process of Claim 88 wherein the bromine is fed as a mixture of bromine vapor and at least one inert gas.

90. A process of Claim 78 wherein said inorganic base and said compound having in the molecule at least one halogenatable amido or imido nitrogen atom are fed either as separate solutions or slurries in water or as a single solution or slurry in water.

91. A process of Claim 90 wherein the inorganic base used in forming the solution, solutions, slurry, and/or slurries is a water-soluble basic salt or oxide of an alkali metal or an alkaline earth metal.

92. A process of Claim 90 wherein the inorganic base used in forming the solution, solutions, slurry, and/or slurries consists essentially of sodium oxide, sodium hydroxide, sodium carbonate, sodium bicarbonate, potassium oxide, potassium hydroxide, potassium carbonate, potassium bicarbonate, calcium oxide, calcium hydroxide, or a mixture of any two or more of them.

93. A process of Claim 84 wherein said pH is in the range of about 6.8 to about 7.2; wherein the temperature of said aqueous reaction mixture is in the range of about 30 to about 90°C; wherein if said brominating agent and/or chlorinating agent is in the form of a vapor, said vapor is fed subsurface to the liquid phase of the reaction mixture in I); and wherein said inorganic base and said compound having in the molecule at least one halogenatable amido or imido nitrogen atom are fed either as separate solutions or slurries in water or as a single solution or slurry in water.

94. A process of Claim 93 wherein the inorganic base used in forming said solution or slurry is a water-soluble basic salt or oxide of an alkali metal or an alkaline earth metal; wherein said brominating agent and/or chlorinating agent is bromine; and wherein the bromine is fed subsurface to the liquid phase of the aqueous reaction mixture in I).

95. A process of Claim 94 wherein the bromine is fed as a mixture of bromine vapor and at least one inert gas.

96. A process of Claim 85 wherein said pH is in the range of about 6.8 to about 7.2; wherein the temperature of said aqueous reaction mixture is in the range of about 30 to about 70°C; wherein if all or a portion of said brominating agent and/or chlorinating agent is in the form of a vapor, at least said vapor is fed subsurface to the liquid phase of said reaction mixture in I); and wherein said inorganic base and said compound having in the molecule at least one halogenatable amido or imido nitrogen atom are fed either as separate solutions or slurries in water or as a single solution or slurry in water.

97. A process of Claim 96 wherein the inorganic base used is a water-soluble basic salt or oxide of an alkali metal or an alkaline earth metal; wherein said brominating agent and/or chlorinating agent is bromine; and wherein the bromine is fed subsurface to the liquid phase of the aqueous reaction mixture in I).

98. A process of Claim 97 wherein the bromine is fed as a mixture of bromine vapor and at least one inert gas.

99. A process of Claim 78 wherein said compound having in the molecule at least one amido or imido nitrogen atom is a hydantoin in which each of the two substituents in the 5-position is, independently, a hydrogen atom or a hydrocarbyl group.

100. A process of Claim 99 wherein said hydantoin is a 5-alkyl hydantoin or a 5,5-dialkylhydantoin.

101. A process of Claim 99 wherein said hydantoin is 5,5-dimethylhydantoin, and wherein said pH is in the range of about 6.8 to about 7.2.

102. A process of Claim 101 wherein the temperature of said aqueous reaction mixture is in the range of about 20 to about 80°C, and wherein if all or a portion of said brominating agent and/or chlorinating agent is in the form of a vapor, at least said vapor is fed subsurface to the liquid phase of said reaction mixture in I).

103. A process of Claim 102 wherein said temperature is in the range of about 40 to about 60°C.

104. A process of Claim 101 wherein the proportions of water, inorganic base, and 5,5-dimethylhydantoin being fed are such that:

A) where the inorganic base has a monovalent cation, there are from about 0.5 to about 2.5 moles of 5,5-dimethylhydantoin, and from about 1.0 to about 5.0 moles of the base, per liter of water; and

B) where the base has a divalent cation, there are about 0.5 to about 2.5 moles of 5,5-dimethylhydantoin, and from about 0.5 to about 2.5 moles of the base, per liter of water.

105. A process of Claim 101 wherein the proportions of water, inorganic base, and 5,5-dimethylhydantoin being fed are such that:

A) where the inorganic base has a monovalent cation, there are from about 1.0 to about 1.5 moles of 5,5-dimethylhydantoin and from about 2.0 to about 3.0 moles of the base, per liter of water; and

B) where the base has a divalent cation, there are about 1.0 to about 1.5 moles of 5,5-dimethylhydantoin and from about 1.0 to about 1.5 moles of the base, per liter of water.

106. A process of Claim 101 wherein said brominating agent and/or chlorinating agent is bromine, chlorine, bromine chloride, or a combination of any two or all three of them, and is fed subsurface to the liquid phase of the aqueous reaction mixture in I).

107. A process of Claim 101 wherein said brominating agent and/or chlorinating agent is an alkali metal bromide or an alkaline earth metal bromide and chlorine, hypochlorite salt, or an aqueous hypochlorite solution in amounts sufficient to generate bromine *in situ*, and wherein if chlorine is used, said chlorine is fed subsurface to the aqueous reaction mixture in I).

108. A process of Claim 101 wherein said brominating agent and/or chlorinating agent is bromine, and wherein the bromine is fed subsurface to the aqueous reaction mixture in I).

109. A process of Claim 108 wherein the bromine is fed as a mixture of bromine vapor and at least one inert gas.

110. A process of Claim 101 wherein said inorganic base and said 5,5-dimethylhydantoin are fed either as separate solutions or slurries or as a single solution or slurry in water.

111. A process of Claim 110 wherein the inorganic base used in forming the solution, solutions, slurry and/or slurries is a water-soluble basic salt or oxide of an alkali metal or an alkaline earth metal.

112. A process of Claim 101 wherein the inorganic base used in forming the solution, solutions, slurry, and/or slurries consists essentially of sodium oxide, sodium hydroxide, sodium carbonate, sodium bicarbonate, potassium oxide, potassium hydroxide, potassium carbonate, potassium bicarbonate, calcium oxide, calcium hydroxide, or a mixture of any two or more of them.

113. A process of Claim 110 wherein the temperature of said aqueous reaction mixture is in the range of about 40 to about 60°C; wherein if all or a portion of said brominating agent and/or chlorinating agent is in the form of a vapor, at least said vapor is fed subsurface to the liquid phase of the aqueous reaction mixture in I); and wherein the proportions of water, inorganic base, and 5,5-dimethylhydantoin being fed are such that:

A) where the inorganic base has a monovalent cation, there are from about 0.5 to about 2.5 moles of 5,5-dimethylhydantoin and from about 1.0 to about 5.0 moles of the base, per liter of water; and

B) where the base has a divalent cation, there are about 0.5 to about 2.5 moles of 5,5-dimethylhydantoin and from about 0.5 to about 2.5 moles of the base, per liter of water.

114. A process of Claim 113 wherein said brominating agent and/or chlorinating agent is bromine; and wherein the bromine is fed subsurface to the liquid phase of the aqueous reaction mixture in I).

115. A process of Claim 114 wherein the bromine is fed as a mixture of bromine vapor and at least one inert gas.

116. A process of Claim 113 wherein the proportions of water, inorganic base, and 5,5-dimethylhydantoin being fed are such that:

A) where the inorganic base has a monovalent cation, there are from about 1.0 to about

1.5 moles of 5,5-dimethylhydantoin and from about 2.0 to about 3.0 moles of the base, per liter of water; and

B) where the base has a divalent cation, there are about 1.0 to about 1.5 moles of 5,5-dimethylhydantoin and from about 1.0 to about 1.5 moles of the base, per liter of water.

117. A process of Claim 116 wherein said brominating agent and/or chlorinating agent is bromine; and wherein the bromine is fed subsurface to the liquid phase of the aqueous reaction mixture in I).

118. A process of Claim 117 wherein the bromine is fed as a mixture of bromine vapor and at least one inert gas.

119. A process of Claim 78 wherein said compound having in the molecule at least one halogenatable amido or imido nitrogen atom is a cyclic amide or a cyclic imide.

120. A process of Claim 13 or 78 wherein the process is conducted adiabatically and with agitation of the aqueous reaction mixture.

121. A process of Claim 100 or 101 wherein the halogen is bromine and wherein the rate at which the feeds are being fed is such that the color of the reaction mixture is yellow to reddish yellow.

122. A process of any of Claims 78, 93, 96, or 119 wherein the proportions of said brominating agent and/or chlorinating agent and said compound having in the molecule at least one halogenatable amido or imido nitrogen atom being fed are such that there are in the range of about 1.9 to about 2.1 atoms of halogen per halogenatable amido or imido group to be halogenated.

123. A process of any of Claims 101, 102, 106, 107, 110, 113, 116, or 117 wherein the proportions of halogen and 5,5-dimethylhydantoin being fed are such that there are in the range of about 3.8 to about 4.2 atoms of halogen per molecule of 5,5-dimethylhydantoin.

124. A process for the N-halogenation of a compound having in the molecule at least one halogenatable amido or imido functional group in the molecule, which process comprises:

a) concurrently feeding into a reactor (i) water, inorganic base, and said compound having in the molecule at least one halogenatable amido or imido nitrogen atom, these components being fed separately and/or in any combination(s), and (ii) a separate feed of a brominating agent, in proportions such that (iii) at least one said amido or imido nitrogen atom is substituted by a bromine atom, (iv) during all or substantially all of the time the concurrent feeding is occurring, the product precipitates in the liquid phase of an aqueous reaction mixture in which the pH is continuously or substantially continuously maintained in the range of about 5.5 to about 8.5, and (v) an aqueous solution of co-product inorganic bromide salt is formed;

b) separating precipitate from said aqueous solution; and

c) oxidizing co-product inorganic bromide salt in said solution to form elemental bromine.

125. A process of Claim 124 wherein said oxidation is accomplished using chlorine.

126. A process of Claim 124 wherein said pH is in the range of about 6.5 to about 8.5.

127. A process of any of Claims 124-126 wherein said compound having at least one halogenatable amido or imido nitrogen atom is a 5,5-dialkylhydantoin; wherein said inorganic base is a water-soluble basic salt or oxide of an alkali metal or an alkaline earth

metal; and wherein said brominating agent is bromine fed subsurface to the liquid phase of the aqueous reaction mixture.

128. A process of Claim 124 wherein said compound having in the molecule at least one halogenatable amido or imido nitrogen atom is 5,5-dimethylhydantoin; wherein said pH is maintained in the range of about 6.8 to about 7.2; and wherein the temperature of said reaction mixture is maintained in the range of about 40 to about 60°C.

129. A process of Claim 124 wherein in a) the feeds are being fed such that the color of the aqueous reaction mixture is yellow to reddish yellow.

130. A process of any of Claims 13, 43, or 58 wherein said brominating agent and/or chlorinating agent is a brominating agent whereby an aqueous solution of co-product inorganic bromide salt is formed; wherein precipitate is separated from said aqueous solution; and wherein co-product inorganic bromide salt in said solution is oxidized to form elemental bromine.

131. A process of Claim 78 wherein said brominating agent and/or chlorinating agent is a brominating agent whereby co-product inorganic bromide salt is formed in the aqueous reaction mixture; wherein the inorganic bromide salt in the aqueous solution remaining after said precipitate has been removed therefrom is oxidized to form elemental bromine.